REMARKS

This is a Preliminary Amendment in which claims 1-11 have been amended and claims 12-39 have been added. An early and favorable action is earnestly solicited.

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Respectfully submitted

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Attorney's Docket No. S1022/8494 (JHM)
Dated: September 24, 2002
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AMENDED CLAIMS SHOWING CHANGES MADE

1. (Amended) A far-end crosstalk canceling circuit for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems adapted to receive [receiving] discrete multitone signals from corresponding network termination modems over a plurality of transmission channels, each of the plurality of line termination modems [modem] comprising time/frequency transforming means for transforming said discrete multitone signals into a discrete multitone symbol of frequency components and demapping means for outputting for each frequency component [the] a symbol of a [the] constellation nearest [thereto] to each frequency component and [the] corresponding demodulated data, the far-end crosstalk canceling circuit comprising[;]:

estimation means, in at least one line termination modem, for estimating [the] constellation symbols actually sent by the network termination modems[,] from the frequency components of the discrete multitone symbols [received] generated by the plurality of line termination [all] modems;

calculation means for calculating a linear combination of said estimated constellation symbols, [modulated data, for] subtracting said linear combination from the frequency components [of] generated by said at least one line termination modem, and [for] applying a resulting difference to the demapping means of the [said] at least one line termination modem;

error calculation means for calculating an [the] error distance between the [constellation] symbol of the constellation output from the [said] at least one line termination modem and said resulting difference; and

updating means for updating [the] coefficients of said linear combination as a function of said error distance.

2. (Amended) The far-end crosstalk canceling circuit of claim 1, wherein the estimation means further comprises means for providing [provides] the symbols of the constellations [constellation points] respectively output by the demapping means [demappers] of the plurality of line termination modems as estimates of [for the] modulated data sent by the corresponding network termination modems.

3. (Amended) The far-end crosstalk canceling circuit of claim 1, wherein the estimation means further comprises switching means for outputting the frequency components in a first step, and the estimated constellation symbols[,] obtained therefrom in a second step [as estimates for the modulated data].

4. (Amended) The far-end crosstalk canceling circuit of claim 1, wherein:

the estimation means is common to all of the plurality of line termination modems and simultaneously provides the discrete multitone symbols as estimates for consecutive constellation symbols;

the calculating means is common to all of the plurality of line termination modems and comprises matrix calculation means calculating at time t a [the] product H^{-1}_{t-1}*R of a matrix H^{-1}_{t-1} with a [the] vector R, R being [a vector] constituted by all [the] sets of frequency components Ri, the matrix H^{-1}_{t-1} being an estimate at time t-1 of [the] an inverse of a [the] transfer matrix of the plurality of transmission channels;

the error calculating means is common to all of the plurality of line termination modems and calculates the error distance as between each of [the] n components of the product [vector] H^{-1}_{t}*R and the [constellation] symbols of the constellations output by the respective demapping means [demappers] of the plurality of line termination modems; and

the updating means is common to all of the plurality of line termination modems and updates [the] coefficients of the matrix H^{-1}_{t-1} as a function of said error distance.

5. (Amended) The far-end crosstalk canceling circuit of claim 1, further comprising parallel to serial converters for transforming the sets of frequency components [discrete multitone symbols] Ri into respective serial streams of frequency components, wherein:

the estimation means is common to all of the plurality of line termination modems and simultaneously provides the frequency components as estimates for the constellation symbols;

the calculating means is common to all of the plurality of line termination modems and comprises matrix calculation means sequentially calculating at time t, for each tone j a [the] product $H^{-1}_{t-1}(fj)$*R(fj) of a matrix $H^{-1}_{t-1}(fj)$ with a [the] vector R(fj) constituted by all the frequency components Ri(fj) at a [the] frequency fj, $H^{-1}_{t-1}(fj)$ being an estimate at time t-1 of an

[the] inverse of a [the] transfer matrix at the frequency fj of the plurality of transmission channels;

the error calculating means is common to all of the plurality of line termination modems and sequentially calculates for each tone j the error distance as between each of the n components of the [vector] product $H^{-1}_{t}(fj)*R(fj)$ and [the] constellation points $\hat{S}\,i(fj)$ output by the respective demapping means [demappers] of the plurality of line termination modems;

the updating means is common to all of the plurality of line termination modems and sequentially updates for each tone j [the] coefficients of the matrix $H^{-1}_{t-1}(fj)$ as a function of said error distance.

6. (Amended) A digital subscriber line transmission system comprising a far-end crosstalk canceling circuit according to claim 4, in which the plurality of line termination modems and corresponding network termination modems are of [the] a synchronous Zipper type.

7. (Amended) A far-end crosstalk canceling method for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems adapted to receive [receiving] discrete multitone signals from corresponding network termination modems over a plurality of transmission channels, each of the plurality of line termination modems [modem] comprising frequency transforming means for transforming said discrete multitone signals into a discrete multitone symbol of frequency components, and demapping means for outputting for each frequency component [the] a symbol of the constellation nearest [thereto] to each frequency component and [the] corresponding demodulated data, the method comprising the steps of:

estimating, for at least one line termination modem, [the] constellation symbols actually sent by [all] the network termination modems, from the frequency components of the discrete multitone symbols [received] generated by [said] the plurality of line termination modems;

calculating a linear combination of said estimated constellation symbols, subtracting said linear combination from the frequency components [of discrete multitone symbol] generated by the at least one line termination modem, and applying [the] a resulting difference to the demapping means of the [said] at least one line termination modem, to obtain [a constellation]

the symbol of the constellation;

calculating the error distance between the [said constellation] symbol of the constellation and said resulting difference; and

updating [the] coefficients of said linear combination as a function of said error distance.

8. (Amended) The far-end crosstalk canceling method of claim 7, wherein the [estimation step provides] step of estimating further comprises providing the [constellation] symbols of the constellations respectively output by the [demappers] demapping means of the plurality of line termination modems[,] as estimates [for the symbols] of modulated data sent by the corresponding network modems.

9. (Amended) The far-end crosstalk canceling method of claim 7, wherein the [estimation step provides, as estimates for the symbols,] step of estimating further comprises providing the frequency components in a first step and the estimated constellation symbols obtained therefrom in a second step.

10. (Amended) The far-end crosstalk canceling method of claim 7, wherein:

the step of estimating [estimation step] is carried out for all of the plurality of line termination modems and simultaneously provides the frequency components as estimates for consecutive constellation symbols;

the step of calculating [calculation step] is carried out for all of the plurality of line termination modems and comprises [the calculation] calculating at step t [of the] a product $H^{-1}_{t-1}*R$ of a matrix H^{-1}_{t-1} with a vector R, R being [a vector] constituted by [all the] n [DMT] discrete multitone symbols Ri, the matrix H^{-1}_{t-1} being an estimate at step t-1 of [the] an inverse of [the] a transfer matrix of the plurality of transmission channels;

the step of calculating the error distance [error calculating step] is carried out for all of the plurality of line termination modems and calculates the error distance[s] as between each of [the] n components of the [vector] product $H^{-1}_{t-1}*R$ and the [constellation] symbols of the constellation output by the respective [demappers] demapping means of the plurality of line termination modems; and

the act of updating [step] is carried out for all of the plurality of line termination modems and updates [the] coefficients of the matrix H^{-1}_{t-1} as a function of said error distance.

11. (Amended) The far-end crosstalk canceling method of claim 7, further comprising a step of:

[a] parallel to serial [conversion of] converting the discrete multitone symbols into respective serial streams of frequency components;

wherein:

the step of estimating [estimation step] is carried out for all of the plurality of line termination modems and simultaneously provides the frequency components as estimates for the constellation symbols;

the step of calculating [calculating step] is carried out for all of the plurality of line termination modems and sequentially calculates at step t, for each tone j, a [the] product $H^{-1}_{t-1}(fj)*R(fj)$ of a matrix $H^{-1}_{t-1}(fj)$ with a [the] vector R(fj) constituted by all the frequency components Ri(fj) at a [the] frequency fj, $H^{-1}_{t-1}(fj)$ being an estimate at time [step] t-1 of an [the] inverse of a [the] transfer matrix at the frequency fj of the plurality of transmission channels;

the step of calculating an error distance [error calculating step] is carried out for all of the plurality of line termination modems and sequentially calculates, for each tone j, a [the] sum of the error distance as between each of [the] n components of the [vector] product $H^{-1}_{t}(fj)*R(fj)$ and [the] constellation symbols $\hat{S}$ i(fj) output by the respective [demappers] demapping means of the plurality of line termination modems;

the step of updating [step] is carried out for all of the plurality of line termination modems and sequentially updates for each tone j [the] coefficients of the matrix $H^{-1}_{t-1}(fj)$ as a function of said error distance.